

# Did Gold Remain Relevant in the Post-1971 International Monetary System?

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## Abstract<sup>1</sup>

The central hypothesis to be tested is the relevance of gold in the determination of the value of the US dollar as an international reserve currency after 1971. In the first section the market value of the US dollar is analysed by looking at new forms of value (financial derivative products), the dollar as a safe haven, the choice of a standard of value and the role of SDRs in reforming the international monetary system. Based on dimensional analysis, the second section analyses the definition and meaning of a numéraire for international currency and the justification for a variable standard of value based on a commodity (gold). The second section is the theoretical foundation for the empirical and econometric analysis in the third and fourth sections. The third section is devoted to the specification of an econometric model and a graphical analysis of the data. It is clear that an inverse relation exists between the value of the US dollar and the price of gold. The fourth section shows the estimations of the different specifications of the model including linear regression and cointegration analysis. The most important econometric result is that the null hypothesis is rejected in favour of a significant link between the price of gold and the value of the US dollar. There is also a positive relationship between gold price and inflation. An inverse statistically significant relation between gold price and monetary policy is shown by applying a dynamic model of cointegration with lags.

**Key words:** Money, value, benchmark, gold, dollar, regression, cointegration.

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## Introduction

Nowadays most economists reject any connection between money and a particular commodity (gold). They propose state money while ignoring the need for *international currency* to be linked to the real world by a benchmark as a standard of values or prices. Today's economists who follow Ricardo's ideas consider money as a medium of circulation and reject or minimize the store-of-value function which can also be viewed as a reserve-of-purchasing-power. The concept of a store of value is non-existent in a Walrasian general equilibrium for money because if supply and demand is in equilibrium there will be no excess of money to store or to hoard. The money store-of-value function is also incompatible with an equilibrium circuit of money so frequently postulated by some post-Keynesians. The store-of-value function or the reserve-of-purchasing-power function is at the heart of Marx's circuit of money capital which has been analysed in Loranger (1982, 1986).<sup>2</sup> The central question to be examined in this article is whether the world's reserve currency was linked in any way to the real world after its official link to gold was cut in 1971. Most economists reject the idea that the dollar as a reserve currency is linked to a commodity--in particular to gold. Some argue that the US dollar is strong enough to stand by itself and its liquidity is desirable in a time of financial crisis because the quantity of gold is not significant with respect to the quantity of dollars used either in international transactions or as a currency reserve.<sup>3</sup> The latter argument is not convincing because at the time of the gold standard in the 19<sup>th</sup> century most transactions were made in sterling instead of gold. The quantity of sterling in circulation or in reserve was far more important than the gold reserve. When questioning the value of one unit of sterling being equal to a quantum of gold the answer was clear and immediate as the "*de jure*" definition was accepted at the world level. Through the *exchange rate system* each domestic currency was linked to an international currency and, consequently, linked to a benchmark elected as a general equivalent. The distinction between a "*de jure*" and a "*de facto*" situation is justified by the change in the exchange rate regime from 1971: except for certain countries, the fixed exchange rate system was abandoned in favour of a variable exchange system. A similar movement followed with the

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<sup>2</sup> In addition to the classical industrial circuit of capital, a monetary or credit circuit is added and there is a possibility that the monetary circuit does not close and remains in disequilibrium with the real circuit. The existence of value reserve now becomes important and we are confronted with three possible cases analogous to Minsky's financial instability hypothesis: hedge, speculative or Ponzi situations.

<sup>3</sup> This view was defended by the Stanford School whose proponents were C. Kindleberger, E. Déprés, W. Salant and later by H. Johnson, M. Friedman and many others. One could add that when the international monetary system is under pressure because of the threatened explosion of the euro, speculators convert their gold reserve into dollars in order to have more liquidity to pay off their obligations.

standard of money value; the fixed standard of value for money with respect to gold was replaced by a variable standard of value. This is the hypothesis to be tested in this article. From a “*de jure*” viewpoint, there is no link between international currency and a commodity (gold) since 1971. However, from a “*de facto*” viewpoint the link still exists. An important question to consider is how does the market define a benchmark (fixed or variable over time) and, if it is necessary, can the benchmark be changed or reinterpreted?

Two recent publications invite a rethinking of the problem in terms of money-commodity *The Value of Money* by Patnaik (2009) and *Capitalism with Derivatives* by D. Bryan & M. Rafferty (2006). Patnaik’s conclusion is that oil is the money benchmark while Bryan & Rafferty’s conclusion is that derivatives are the new “commodity” (risk as a meta-commodity) benchmark for money. In November 2010 Robert Zoellick, the President of the World Bank said, “This new system is likely to need to involve the dollar, the euro, the yen, the pound and a renminbi [yuan] that moves towards internationalisation. The system should also consider employing gold as an international reference point of market expectations for inflation, deflation and future currency values.”<sup>4</sup> Robert Mundel (1997) predicted the comeback of gold in the early 21<sup>st</sup> century when he said, “More likely, gold will be used at some point, maybe in 10 or 15 years when it has been banalized among central bankers, and they are not so timid to speak about its use as an asset that can circulate between central banks. Not necessarily at fixed price, but a market price.”<sup>5</sup>

Firstly, the intent of this paper is to discuss the value of the US dollar as an international currency reserve and its evolution since the end of the dollar-gold link in 1971. This evolution is characterized by the emergence of financial derivatives after 1972 and the search for a new benchmark linking the dollar to the real world. Four types of commodities are usually recognized as benchmarks:

- Labour power as a commodity. This is the choice of most Keynesian and Marxist economists, although it comes from very different hypotheses.<sup>6</sup>
- Gold as a variable standard of value as seen in R. Zoellick, in R. Mundel and is the preferred hypothesis presented in this paper.

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<sup>4</sup> R. Zoellick, Financial Times (11/08/10) Underlining has been added.

<sup>5</sup> R. A. Mundel (1997). Underlining has been added. Since last year, central banks are now net buyers of gold. In the late 1990s gold was widely dismissed by central bankers as a reserve asset, so much so that the Bank of England and the Bank of Canada (to name only these two) sold all their gold reserves.

<sup>6</sup> Gill (2011) is one of the rare Marxist economists who maintained that there is a link between labour value, money and gold. Most Marxist economists are happy with the MELT concept (monetary expression of one unit of labour time) to link money with labour. See section 2.3 for a more complete explanation.

- SDR based on a basket of other commodities as advocated by China, France, Russia, India and Brazil.
- Oil as an alternative standard is the preference of some economists including P. Patnaik.

The second aim is to discuss the definition of a numéraire and the concept of a variable standard of value to better understand the value of money linked to a commodity. With the help of dimensional analysis, one can demonstrate the formal correspondence between Walras' and Marx's numéraire which is defined as any particular commodity for Walras and a quantum of a certain commodity assumed to be gold in Marx's form IV.<sup>7</sup> Although most economists reject any connection between money and a particular commodity (gold) due to the existence of legal tender money in every country, it will be shown that the reduction of the real world to a dimensionless number (see section 2.2.1) is equivalent to showing that money is neutral and has no meaning *per se*. This hypothesis is faulty because it disregards the importance of money's link to the real world. The *de facto* variable standard of value assumed paramount importance once the link between US dollar and gold was officially removed, historically creating a rather exceptional situation for an international reserve currency.<sup>8</sup> A third aim is to show that a strong link exists between the price of gold, the value of the US dollar and other key financial variables (i.e. Dow-Jones index, interest rate and inflation). This is achieved by an empirical analysis based on monthly observations from 1971 which was the year that the Bretton Woods Accord ceased to exist. An econometric analysis will validate what can be observed by a simple inspection of the data. Assuming that  $\beta$  is a parameter linking the value of the dollar to gold, the null hypothesis to be tested is  $\beta = 0$ , that is, there is no link between the value of the dollar and the value of gold. Therefore, if  $\beta \neq 0$  this shows that the demonetization of gold is a myth in theory as well as in reality.

## **1.0 The market value of the US dollar and its new forms**

### **1.1 The form of the universal currency**

In ancient times, each empire had the power to create its own money which circulated in other countries and insured its support by conquering the wealth of other nations. Presently, the situation of the dollar is not much different; *however the form of value is more sophisticated because of the financial innovations that increasingly characterised its sway as an international*

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<sup>7</sup> In the French edition edited by Marx.

<sup>8</sup> See in particular B. Eichengreen (2011). He outlines that the rejection of gold as a universal currency is a very unusual situation over time except for temporary periods of non-convertibility due to wars, catastrophes or other unforeseen black swans.

*reserve currency*. Writings on the topic of the 1980's international financial markets certainly showed that these innovations were not as sophisticated as they are today (Loranger, 1982). The development of the Eurodollar phenomenon allowed private banks and/or other investors to have access to dollars outside of US financial markets including borrowing on the world market. However, these measures were insufficient because many developing countries were forced to accept structural adjustment plans with strict conditionality because they did not have the necessary creditworthiness. Continuous deregulation starting in the early 1980s with the Reagan administration led to the unlimited development of financial markets, the emergence of many kinds of derivative products and the securitization of debts (slicing and repackaging debts) and also the rise of securitized lending. By the 1990s, these risk management instruments became a new commodity that could be exchanged on markets in the same manner as other financial products. Therefore, ABS, ABCP, CDO, CDS<sup>9</sup> etc. were developed and traded by Wall Street bankers and their imitators in Europe and in other countries which had the financial strength to issue and sell them. Since many of these products were difficult to price according to their risk factor, the market for them brutally collapsed in 2007 and created the largest financial meltdown at the world level.<sup>10</sup>

## **1.2 Expansion of financial derivatives**

The notional value of a derivative contract corresponds to the value of the underlying security (shares, bonds, etc.). Since the underlying security is supposed to be related to a physical capital asset, the notional value of a derivative is simply another instrument which, like shares, transcends time and space because it can be bought and sold anytime and anywhere when the value is based on a physical asset located in real time and space. Therefore, the market value of a derivative contract is the amount of money required to purchase it as opposed to purchasing shares or bonds related to physical assets (see Table 1). This is an important advantage for banks, other financial institutions (hedge funds), firms and individuals which gives them the leverage to buy large amounts of notional capital with a small quantity of liquidities or by borrowing instead of reducing their liquidity.<sup>11</sup> Securities can be unbundled, repackaged and sold as a different

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<sup>9</sup>The acronyms are: Asset Back Securities, Asset Back Commercial Papers, Collateralized Debt Obligations, Credit Default Swaps, respectively.

<sup>10</sup>The market collapse for these products was unforeseen because traders used econometric models that assumed risk randomness. The models did not take into account systemic risk arising from the mimetic behaviour of investors. Moreover, though these models were supposed to sustain an 'originate and distribute' model, they actually resulted in a concentration of risk in certain financial institutions leading to their collapse. Totally ignored was Minsky's hypothesis of financial fragility where risky behaviour (Ponzi finance) increases with the length of the business cycle. See in particular in Barbera (2009).

<sup>11</sup> The power of leveraging is at the heart of the financial fragility of the banking system with ratios of 40 or 60 to 1 for the most speculative institutions. For instance, one pays \$5 to buy a derivative of \$200 which

security where risk is divided and spread between many investors who buy ABS, ABCP, CDO, and CDS. Bryan & Rafferty's book (2006) is an important contribution to understand the role and development of financial derivatives as a consequence of unlinking the dollar to gold, the beginning of rising uncertainty for the exchange rate and the need to find a new benchmark for the value of the dollar. They considered risk as a "meta commodity," a hypothesis that I reject,<sup>12</sup> but it is a serious theoretical contribution to the subject of the equivalence problem between money and the real world in the post-1971 international monetary system. Bryan & Rafferty see these financial instruments as a new way to value firms' assets in time and space. They state:

*The commensuration properties of financial derivatives mean that the logic of capital is driven to the center of corporate policy making. Assets that do not meet profit-making benchmarks must be depreciated, restructured and/or sold. The decision not to do so is now more readily exposed to market scrutiny, as investment bankers use derivatives and derivatives' prices to unbundle the performance of the different assets and liabilities of firms.*<sup>13</sup>

Table 1 shows the importance of the development of derivatives over the last ten years. Their phenomenal expansion is an indication of the volatility of financial markets and in particular, the uncertainty generated by the floating exchange rate system. It is no surprise that a crisis of exchange rates is developing around the world and a reform of the international monetary system is necessary if one wants to reduce uncertainty around exchange rates (see Table 1c).

A unanimous agreement does not exist for the definition and measurement of derivatives.

Table 1 Importance of financial derivatives										
1a) Outstanding Derivative contracts Notional amount Dec. (trillions \$,)										
	2001		2004		2007		2009		2011 (1 <sup>st</sup> half)	
OTC (Over the Counter)	111	82%	220	84%	596	89%	615	90%	642	91%
Organised Exchanges	24	18%	47	16%	72	11%	73	10%	65	9%
Total	135	100%	295	100%	668	100%	688	100%	707	100%
Market value	3.8		6.4		15.8		21.6		20	

gives a ratio of 40. Because derivatives are contingent values they are not reported in a firm's balance sheet. But accounting rules could change with financial reform at the world level.

<sup>12</sup> The weakness of risk or meta-commodity as a variable standard of value is that it is fractioned in many different forms and is changing continuously over time.

<sup>13</sup> Bryan & Rafferty (2006). Financial derivatives like ABS and CDO contracts on exchange rates and other types of derivatives are ultimately related to physical assets, even when they are piled over each other to form a new derivative. This is why they are difficult to value and why the German chancellor, in particular, was reluctant to support their expansion.

<b>1b) Distribution of the total OTC (707T) in 2011 by type of contract</b>					
Interest 78%, Foreign Exchange 9%, CDS 5%, equity-linked and commodity 1.5%, others (unallocated) 11.2%					
<b>1c Foreign exchange market and daily turnover (trillions \$)</b>					
Notional amount (OTC)	16.7	31.5	57.6	49.2	65
Market value (Average Dec.)	0.7	1.9	3.3	2.1	2.3
Daily turnover (Daily average April)	1.5	2.1	3.4	4.1	4.0 ( 2010)
Annual turnover (240days)	360	456	792	960	960
Source: BIS, Triennial Survey 2010, Quarterly Review I, 2012					

According to the Bank of International Settlements (BIS), the notional amount of OTC derivatives contracts and the notional amount of organised exchanges totalled 707 trillion dollars at the end of June 2011. The largest of these transactions is on interest rate. The growth over the seven year period (2001-2007) is 410% representing an average annual growth of 59%. One observes, however, that the financial meltdown 2007-09 brutally stopped that growth which increased by only 7.7% from 2007 to 2011<sup>14</sup> giving an average annual increase of only 3% . However, since 2007, the market value of derivatives has increased by 37%.<sup>15</sup> Another interesting characteristic of this phenomenon is that transactions on organized markets have been continuously losing ground and represent only 9% of the total value of derivative contracts in 2011. Because banks make the largest portion of OTC contracts their power is more concentrated than ever. With foreign exchange contracts representing only 9% of total transactions in 2011, it is interesting to examine this subsector in terms of turnover while considering the idea of taxing this particular type of transaction. Also revealing is the increasing volatility of the value of money and the numerous exchange rate crises that cannot be stopped without reforming the International Monetary System. One observes the rapid growth of notional foreign exchange contracts between 2001 and 2007; however, growth stopped and turned negative (-15%) between 2007 and 2009, moving from 57.6 trillion dollars to 49.2 trillion then resuming its growth over the last two and a half years to 65 trillion. The market value of foreign exchange contracts had an accelerated growth for the period 2001-2007 moving from 0.7 trillion dollars in 2001 to 3.3 trillion in 2007 with a decrease of 30% over the last three years. The impact of the great financial crisis is clearly

<sup>14</sup>  $(642 - 596 = 46 / 596 = 7.7\%)$

<sup>15</sup>  $(21.6 - 15.8 = 5.8 / 15.8 = 37\%)$

shown by these figures. The yearly turnover of foreign exchange derivatives is now hovering around 1000 trillion dollars. A Tobin tax of one tenth of one percent would produce revenues of one trillion dollars. The scale of these transactions may appear to be exaggerated because hedging in financial derivatives (offsetting an existing position) is quite common. Since the world GDP is estimated around 60 trillion in 2009<sup>16</sup> this is approximately ten times less than the notional figure of OTC derivative contracts. According to Bryan & Rafferty, it is neither possible nor desirable to eliminate financial derivatives because they are the new vehicles for storing the value of money. They also consider that derivatives are the new standard of value and form of holding wealth which changes in time and space (a variable standard of value). Bryan & Rafferty wrote:

*...valuation across space, time, and between different asset forms is the stuff of derivatives. Derivative traders....operate in a world of perceived equivalence but, and this is critical, it is not a fixed equivalence – for if equivalence were fixed, there would be no need for derivatives” (B. & R. p. 36) [Derivatives] are commodities that manage risk. And because risk exposure is so changeable, the market for these risk management commodities has acquired a high level of liquidity (volume and mobility) with many of the characteristics of money....Derivatives constitute new private global money. (B. & R. p.38)*

It would be more accurate to describe derivatives as a new form of money as in bills, credit cards and credit money preferred as a means of exchange and payment in certain situations. Bryan & Rafferty affirm that no difference exists between derivatives and money --with derivatives serving as a benchmark for unknowable fundamental values.<sup>17</sup> In Marxian analysis, abstract labour values are unknowable values and money is the *raison d'être* for revealing those values through the market place.<sup>18</sup> Derivatives play a similar role to the Marxian approach but the problem with the definition of the standard of value or benchmark for money remains an unresolved problem in the Bryan-Rafferty approach. This new style of trading became necessary because of the uncertainty and risks emanating from the regime of fluctuating exchange rates and deregulation in banking and financial institutions at the world level. The most important cause is the termination of the fixed definition of the US dollar with gold in 1971. In 1972 the Chicago Mercantile Exchange introduced the first derivative in currencies. The Chicago Board of Trade introduced the first derivative in interest rates in 1975 and the Chicago Board Option Exchange

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<sup>16</sup> World Economic Outlook, IMF, April 2010.

<sup>17</sup> For B. & R, fundamental values are unknowable because they are not fixed but variable equivalence as it is said in the previous quotation.

<sup>18</sup> Marxists consider MELT (monetary expression of one unit of labour time) concrete labour as equivalent to abstract labour in that definition and hence abstract labour is no longer an unknowable value. I beg to differ on this point because the quantity of labour power at the world level is an unknown. A more detailed discussion on the topic is found at the end of section 2.3 on page 20. See also Marx's quotation about universal money as “the immediate social incarnation of human labour in the abstract” on page 16.



(CBOE) was created in 1973 as a market for options that were previously exchanged as OTC (B & R page 94). These new financial institutions were created to counteract the volatility of exchange rates and other financial instruments (shares, bonds...) after the collapse of the Bretton Woods Agreement.

### **1.3 The strength of the U.S. dollar**

Since the variable exchange rate regime is the consequence of the abandonment of an official link between the US dollar and gold, what would the value benchmark of the dollar as a currency reserve be? An incorrect response would be to state that the value of a dollar is defined by a basket of strong currencies such as the euro, yen, Swiss franc, sterling pound, etc ...which states the tautology: a dollar is a dollar! Sadly, this constitutes standard teaching in many macroeconomic courses. Economists cannot justify a fundamental dimension in economics-- money, the medium in which value is determined and expressed by market prices and how it attains its own value with of another commodity used as a general equivalent. As mentioned, this mainstream opinion has been challenged by Patnaik (2009). He wrote,

*“A monetary world necessarily requires..... the fixity of the value of what is used as money vis-à-vis some commodity, be it gold or silver or labour power... Fiat money is as much commodity money as money fixed against gold; it is just that the commodities in the two cases are different. The world has never succeeded in getting out of commodity money.”(Patnaik pp.163-164).*

Patnaik uses the awkward term “propertyist,” meaning that the value of money is determined not by supply and demand as the monetarists claim, but outside of it. He mentions that Keynes and Marx are both non-monetarist economists because Marx specifies that money is determined from outside by a money commodity and Keynes states that the wage rate is given. More explicitly Patnaik says,

*“State backing can at best confer juridical acceptability, but for it to actually function in the economy in a meaningful manner something more is needed and this something is the fact that it has a commodity backing, of the commodity labour power, through the fixity of the money wage rate in any single period.”(Patnaik p. 164).*

In the Marxist approach, it is the labour power of gold miners embodied in the commodity as a general equivalent which reveals the relative value of all other commodities without revealing its own value. According to Patnaik, the stability of the US dollar is now based on the price of oil. As he states,

*“It follows that the present currency arrangement hinges crucially on the stability of the price of the dollar in terms of oil, in the sense at least of the absence of persistent*

*declines in it,*<sup>19</sup> which is why it can be called the oil-dollar standard. No matter what the “de jure” situation, the world has not moved away from commodity money.” (Patnaik p. 208).

Patnaik finished his book in June of 2008 just before the beginning of the financial meltdown that had a tremendous impact on the price of oil with wild fluctuations from \$140 to a low of \$40 and it is now above \$100. Patnaik’s hypothesis about an oil-dollar standard is not supported by the present economic situation (see Graph 1). However, he has a long-term view about the future of the price of oil. He believes that the USA is an imperialist power and wants to keep control over the production and flow of oil from Middle-East countries (including Iran) and will wage war to retain price control over this resource. Here is the unique advantage for an imperialist power in that even if its financial system is fragile the US economy can finance wars and the restructuring of its debt at a near zero interest rate with savings coming from the rest of the world. Any other country in this situation would be declared a failed state—an example being some of the Euro zone countries. This type of crisis will last as long as financial instability continues. As the late H.P. Minsky (1982) would have written, “*It is Happening Again.*”

The next section is devoted to choosing the best variable standard of value between oil and gold and show that oil cannot be a good standard of value as assumed by Patnaik.

#### **1.4 Oil or gold as a standard of value**

First, define a variable standard of value which is elected to be the general (universal) equivalent for all the other commodities. The word “elected” means chosen and accepted universally by people around the world.<sup>20</sup> Actually, one could speak instead of Marx’s form II (total or expanded form of value) where each commodity is taken as a specific equivalent for other commodities which might be gold, petroleum, etc.

*“On the other hand, the expanded expression of relative value, the endless series of equations, has now become the form peculiar to the relative value of the money commodity. The series itself, too, is now given, and has social recognition in the prices of actual commodities. We have only to read the quotations of a price-list, backwards, to find the magnitude of the value of money expressed in all sort of commodities. But money itself has no price.”*<sup>21</sup>

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<sup>19</sup> Underling has been added.

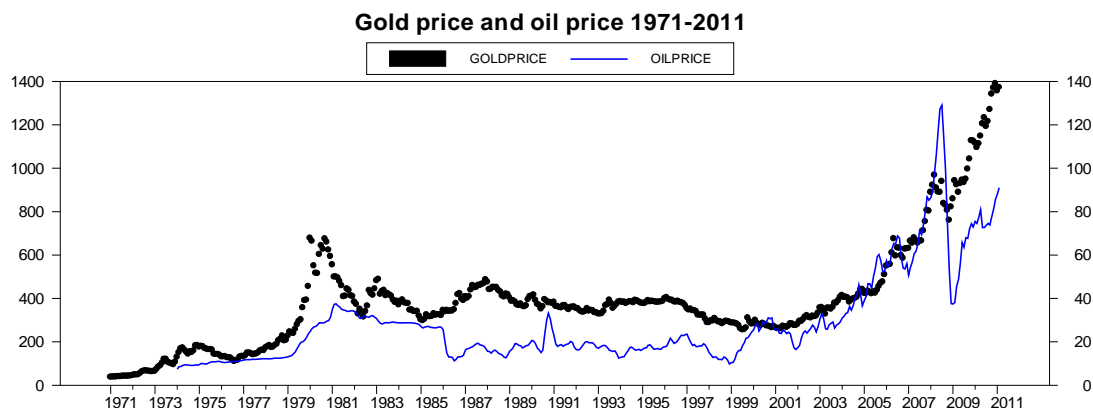
<sup>20</sup> Bryan & Rafferty (2006) in a note on page 150 outline that Menger (1892) saw money as a commodity selected by the market, not by the state. “It is the marketable characteristics of the commodity money ... that sets it apart from other possible money: a process of natural selection by market processes.” Menger contended that it was these qualities, not state decree, that saw precious metals nominated as money.

<sup>21</sup> Marx, (1867), Capital, book 1, chapter 3, page 95. Note that Marx is indifferent in his use of price for relative value. To be more precise, the last sentence should be read: “But money itself has no relative value.”

Speculation on certain basic commodities such as oil, potash, aluminum, copper, silver and gold cannot be understood otherwise. Speculators seek to protect the value of their wealth by exchanging money for commodities or for their derivatives which may, for a certain period of time, be considered better stores of value than the dollar. This clearly shows that the US dollar maintains a link with the real world of commodities. Money is not neutral or abstract for speculators.

Comparing the prices of oil and gold between 1979 and 2012 one sees that the price of oil was around \$20 a barrel at the end of 1979<sup>22</sup> while the market price of gold was around \$375 an ounce compared to its official price (\$46). In March 2012, the price of oil was around \$105 a barrel while the price of gold fluctuated around \$1650 an ounce which is an increase of 5.25 times for the price of oil compared to an increase of 4.4 times for the price of gold. The question is which of these two commodities would be the best standard of value reflecting successive devaluations of the international currency (US\$)? Note in passing that if commodity money like gold has value (labour power of gold miners), its relative value is unknown but its price is determined by the market or by a general agreement which can be far above its cost price. This means that, without speculation, the price of gold might be much lower. If stability is a desirable quality for a standard of value, then gold is more stable than oil. Showing extreme volatility during the great financial crisis the price of oil moved from \$60 in 2007 to above \$130 in 2008 and fell back to \$40 in 2009 while climbing up again to above \$100 by the end of March 2012. The gold price reflects the uncertainty of the US dollar as a reserve currency with its successive devaluations that are close to the inflation rate over the long period.

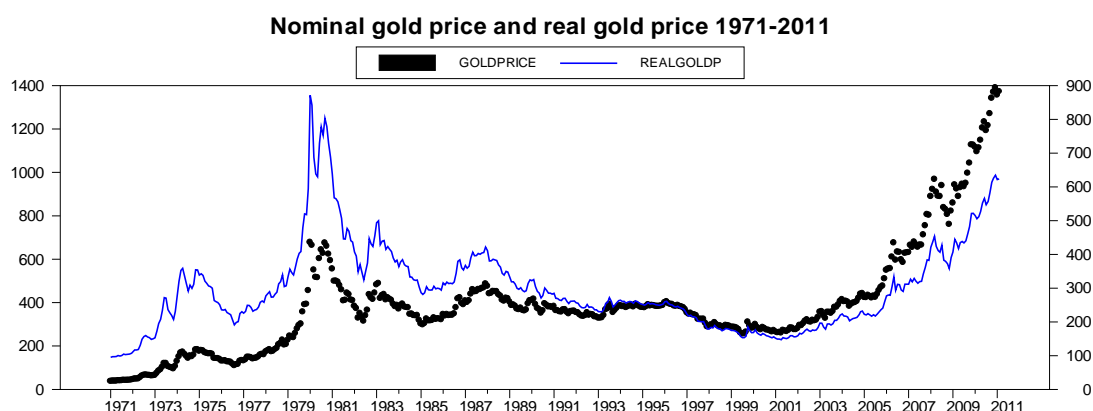
**Graph 1**



Sources: World Gold Council, gold price, London pm fix. Stat Can oil price, table 329-0038

<sup>22</sup> The price of oil doubled after Khomeini's takeover in 1978.

**Graph 2**



Sources: World Gold Council, gold price, London pm fix. StatCan, CPI, table 451-0009.

This can be observed in Graph 2 where the nominal and the real price of gold show somewhat downward sloping curves between 1987 and 2005. To have a clearer picture of the parallel evolution between the price of gold and inflation, one can examine the period between 1983 and 2007 where the data are not affected by the great financial crisis beginning in 2008. The consumer price index in the USA, based at 100 in the period 1982-1983, reached 206 in 2007, hence the value of the index increased by 2.1 times between 1982 and 2007. The price of gold in mid-1983 was \$413 and was \$697 in 2007 with its value increasing 1.7 times for the same period. Since the price index is based on the average of 1982-83 the nominal value and real value of gold are around \$413. The real value of gold at the end of 2010 is \$557 representing an increase of 35% over the twenty eight year period with an average annual growth of 1.25%. This observation is in accordance with what many observers note about gold. In the long run gold is a conservative investment because its price, after adjusting for inflation, gives a low yield and constitutes a rather stable store of value.<sup>23</sup>

Moreover, the quantity of world gold reserves at the IMF which were around 1150 million ounces in 1971 fell to 950 million ounces in 1979 and remained at that level until 1988. Although “demonetarization” of gold was proclaimed--central banks continued to keep a large reserve of it until 1988 (36%). The level of gold reserves has dropped to 10% over the last twenty years.<sup>24</sup> Central banks who have been net sellers of gold in the past (on average of 400 to 500 tons per

<sup>23</sup>Even considering the value of \$1500 reached by gold in mid-June 2011, the real value is around \$665. This represents an average annual increase of 2.1%. As a reader pointed out, the value of the dollar was kept artificially high from 1980s onward, both in relation to gold and oil. The apparent attractiveness of the dollar kept the value of gold artificially low and caused many central banks to sell it just until the crisis.

<sup>24</sup> The proportion was 30% in 1971, 38% in 1978, 36% in 1988, 17% in 1998 and 10% in 2008 (IMF 2008).

year) have now reversed the trend by selling very little in 2009--becoming net buyers of nearly 100 tons in 2010.<sup>25</sup>

**Table 2 Gold demand (Tons)**

	Coins, bars & ETF	Jewellery	Technology	Total
2001	357 (10%)	3009 (81%)	363 (9%)	3729
2005	601 (16%)	2716 (72%)	433 (12%)	3753
2006	676 (20%)	2296 (67%)	462 (13%)	3435
2007	688 (19%)	2414 (68%)	465 (13%)	3571
2008	1181 (31%)	2190 (58%)	439 (11%)	3812
2009	1360 (39%)	1758 (50%)	373 (11%)	3493
2010	1333 (35%)	2060 (54%)	420 (11%)	3812
2011	1641 (40%)	1963 (49%)	463 (11%)	4067

Source: World Gold Council (2011), Gold Demand Trends, table 10. ETF is Exchange Trade Funds or ishare bullion funds.

As reported by the World Gold Council, the estimated total gold demand for 2001 was 3729 tons and ten years later slightly over 4000 tons. However, the change in demand between jewellery and investments as a safe haven is substantial. The proportion of demand for gold as a money commodity changed from 10% in 2001 to 40% in 2011. Note a jump of nearly 100% in gold demand for investments between 2007 and 2011 which was a period of great uncertainty created by the financial crisis. Note also the relative stability of gold demand as an ordinary commodity in the domain of technology (dental and industrial use). The substitution in the gold demand is between jewellery and speculative demand. Both demands constitute hoards but jewellery is less liquid than gold bars and gold ETFs, therefore, indicating a gold rush.

As pointed out by A. Freeman, “The great bulk of all the gold ever produced remains in existence and, indeed, the small volume of actual gold consumption, in comparison to the stock of gold, is a singular feature of gold in comparison with other commodities such as oil...In consequence, what is really going on is a shift to and from hoards, [coins, gold bars] and ornaments or other temporary resting places for gold in which function it has the social use of either display or treasure, that is, an ostentatious hoard.”<sup>26</sup> This form of “gold rush” continued after the announcement by the Fed in November 2010 of a quantitative easing of 600 billion

<sup>25</sup> WGC (2011) Chart 2 Official sector net gold sales since 2000. As mentioned in “The Overview” of the annual report (2011) this reversal of the trend is maintained for 2011.

<sup>26</sup> Personal correspondence with A. Freeman, June 2011.

dollars. The price of gold is now around \$1600 US showing that gold remains a safe haven; its price remains important and deserves an explanation.

As said in the introduction, four possible benchmarks have been suggested to ground the value of money: labour power, gold, oil and SDR. The latter has been advocated by China and other countries.

### **1.5 Critique of China's proposed reform of the IMS**

In March of 2009, the governor of the Central Bank of China, Zhou Xiaochuan spoke in favour of reforming the International Monetary System. He received the support of many countries including India, Russia, France and Brazil. The main proposition made by Mr. Zhou was to give a larger role to SDRs as the new reserve currency which would be independent from major currency economies. Mr. Zhou said, "As an international currency, the SDR should be anchored to a stable benchmark and issued according to a clear set of rules."

The main question is how to define the benchmark? Mr. Zhou favours Keynes' proposition of Bancor which would be based on the value of thirty representative commodities. In Mr. Zhou's view, Bancor would not simply be "fiat" money as proclaimed by Keynesian and post-Keynesian economists. In my opinion it is not necessary to have thirty commodities instead of one like gold or oil.<sup>27</sup> The economic acceptability of a numéraire depends on the market<sup>28</sup> and not on law or regulation by a superpower or an international institution like the IMF.

The market price of gold in SDRs is necessary for grounding international currency to the real world. The importance of a variable price of a SDR in gold shows the world that a particular commodity backs the value of money in SDR. The management of the supply of SDRs and its price will depend on consensus of the international community giving a larger role to the IMF and the willingness of the United States to accept that their currency will be confined exclusively to a national currency. This cannot happen unless the US imperial power is considerably diminished by letting its money be depreciated to a point unacceptable by other countries. A prediction is that the IMF would control the change of the market value of the SDR in the same way that each country controls the exchange rate for its money. For instance, IMF could favour a controlled devaluation of the SDR in the same way as it can augment the quantity of SDRs as any independent central bank does when it wants to augment the liquidity in the system. It could be

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<sup>27</sup> With one money-commodity, one can show the relative value of 30 or more other commodities and reversing the equations of all relative values of commodities, one gets the relative value of the money commodity. The idea of a "basket of commodities" would confuse the issue. Marx's form II (total or expanded form) is a more coherent concept than a basket of commodities.

<sup>28</sup> See Menger's quotation, note 21, page 14.

for trade and balance adjustment, or to give the necessary liquidity to countries that do not have the creditworthiness to borrow from private markets. This position is not a return to a gold standard or a gold exchange standard. It is the continuation of the existing state (a variable standard) with a new independent currency. After a period of transition international financial transactions could be made in SDRs instead of US dollars bringing more stability to financial markets while putting in place a new international monetary system. One must remember that the suppression of the link between gold and the US dollar caused the phenomenal expansion of derivatives whose role was to counter-balance risk generated by uncertainty in the store of value function of international currency. Also the volatility of financial markets cannot be reduced unless there is a major change in the international monetary system. Mr. Zhou seems to share the same viewpoint when he said,

“The centralized management of part of the global reserve by a trustworthy international institution with a reasonable return to encourage participation will be more effective in deterring speculation and stabilizing financial markets... With its universal membership, its unique mandate of maintaining monetary and financial stability, and as an international ‘supervisor’ on the macroeconomic policy of its member countries, the IMF, equipped with its expertise, is endowed with a natural advantage to act as the manager of its member countries reserves.”(Zhou Xiaochuan p. 4).

## **2.0 Numéraire and variable standard of value**

### **2.1 Dimensional analysis**

Some economists admit that a significant link can be observed empirically between the price of gold measured in dollars and the value of money of other countries also measured with respect to the dollar (weighted exchange rates). They consider that such an empirical link is tautological or redundant because the dollar is present on both sides of the equation. A dimensional analysis of the variables will help to clarify the dimension of the  $\beta$  coefficient. If a homogenous relation exists between the two sides of the equation then one would expect  $\beta = [1]$  which is a dimensionless or abstract number with both sides of the equation being of the same dimension. In physics, dimensional analysis is applied to heat and its thermal unit is BTU. Similarly in economics, dimensional analysis is applied to value and its unit of measurement is one unit of money. In economics, there are four fundamental dimensions: [M] for money, [R] for real object, [T] for time and [1] for a number without dimension. All other variables have secondary dimensions derived from fundamental ones. For instance, the dimension of price  $[p] = [MR^{-1}]$ , i.e.

price is a certain quantity of money [M] per unit of [R]. The rules of simple algebra apply to dimensional analysis.<sup>29</sup>

Let [M] the dimension of the dollar (US)

Let [G] the dimension of gold

Let [A] the dimension of money of other countries

Let  $[MG^{-1}]$  the dimension of the price of gold in US dollar

Let  $[AM^{-1}]$  the dimension of the value of the US dollar with respect to the value of money of other countries--that is one unit of dollar equals  $x$ A quantity of money of other countries. When the dollar is devalued, it requires less quantity of money of other countries  $(x-\Delta x)A$ . It is a weighted exchange rate with respect to the dollar.

Let  $[AM^{-1}] \sim \beta[MG^{-1}]$  a proportional relation between the value of the dollar and the price of gold in dollars.

The dimension of  $\beta$  is  $[AM^{-1}][MG^{-1}]^{-1} = [(AG)M^{-2}]$ .

Therefore, the proportionality relation is not homogenous and  $\beta$  is not a dimensionless number.

Another way to look at the proportionality coefficient without M is to specify the inverse of the exchange rate and specify the proportionality relation as  $[MA^{-1}] \sim \alpha[MG^{-1}]$ .

Therefore,  $\alpha = [GA^{-1}]$ . The proportionality coefficient is the value of money of other countries measured in gold. The null hypothesis would be  $\alpha = 0$ , i.e. there is no relation between gold and the value of money. Our maintained hypothesis is  $\alpha \neq 0$ . The econometric analysis in the fourth part becomes crucial to determine whether or not the estimated proportionality coefficient is significant.

## 2.2 Definition of Walras' and Marx's numéraire

Many economists and bankers avoid discussing the numéraire because they are happy with the Walras' relative price approach and limit their conception of money within a national framework which puts an end to the discussion of international reserve currency. They tend to assume that the central bank is the highest authority and imposes a consensus by declaring domestic currency as legal tender money. This legal tender status is extended to private commercial banks because the central bank acts as the lender of last resort and also the state has the power of taxation which gives credibility to state money. This is an accepted fact, but not an excuse for keeping silent about a flexible exchange rate and the necessity for an international currency that connects with the real world. Quoting Marx on universal money:

*"It is only in the markets of the world that money acquires to the full extent the character of the commodity whose bodily form is also the immediate social incarnation of human*

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<sup>29</sup> A good introduction to dimensional analysis is found in F. J. De Jong (1967).



*labour in the abstract. Its real mode of existence in this sphere adequately corresponds to its ideal concept.”(Marx, vol. 1, p. 142).*

The above quote shows the essential weakness in the concept of money made by post-Keynesians. Their implicit assumption is that the State will always be able to control the labour force and establish the creditworthiness of state money. What many post-Keynesians do not realize is that state money is based on a particular commodity: labour power to be disciplined in the framework of a national economy.<sup>30</sup> The question at the international level is which commodity could be used: the labour force of a superpower or some other commodity? Marx’s labour theory of value is at the core of the foundation of money value but he did not consider that the world would dispense with a money commodity. An important point is to show that Marx’s foundation of the value of money based on a commodity remains relevant.

### 2.2.1 The Walras numéraire

Most economists believed that the break from the gold dollar standard after 1971 expelled gold as a money commodity from the international monetary system and that the US dollar is the new numéraire that does not require “a bodily form that is the immediate social incarnation of human labour in the abstract (Marx).” They repeat the tautology a dollar is a dollar, which is equivalent to saying that the dollar as a numéraire is 1 which will be shown below as a logical error.

Referring to Kindleberger’s article (1971) of the N-1 problem, let

$[x_1, x_2, \dots, x_{n-1}, x_n]$  be a bundle of goods and

$[p_1, p_2, \dots, p_{n-1}, p_n]$  be their absolute prices.

Assume that  $x_n$  is chosen as the general equivalent good (numéraire)

The (n-1) relative prices are then  $[p_1/p_n, p_2/p_n, \dots, p_{n-1}/p_n]$ .

Assume that  $p_n = 1$ , a usual assumption in a mainstream macroeconomic course.

The relative prices are therefore  $[p_1, p_2, \dots, p_{n-1}]$ , and they are now expressed *in money prices*. According to the definition of a price, it is a quantity of money per unit of a particular commodity. In dimensional analysis, let’s assume that M is money and  $x_n$  is gold G. If  $p_n = 1$ , then  $[p_n] = [M/x_n] = 1 \rightarrow [M] = [x_n] = [G]$ . Therefore, money M has the same dimension as G because gold is a money commodity chosen as a general equivalent.

Most economists find this an unacceptable statement and they decline to discuss the absolute price system and prefer to stay with a relative price system that avoids committing themselves to choosing a particular commodity. This is very far from Marx’s conception of money where absolute values and prices have a key role in the labour theory of value. In a Walrasian

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<sup>30</sup> Of course, most progressive economists do not share this viewpoint. But most capitalist countries apply an austerity policy which is based on disciplining the labour force.

equilibrium, prices are determined when there is no excess supply and demand for any commodity. This equilibrium rules out the possibility that money can function as a store of value. Many economists think when they assume  $p_n = 1$  they have defined a purely abstract numéraire with no real foundation. Then  $x_n$  should be an abstract number [1] which is a contradiction with respect to the real world to which it belongs by definition.<sup>31</sup>

### 2.2.2 The Marx numéraire

The Marxian formulation starts with exchange values instead of prices, as follows:

Let  $x_A \leftrightarrow y_B \leftrightarrow \dots \leftrightarrow w_D \leftrightarrow z_C$  be equivalence relations between commodities

Let  $[A, B, \dots, D, C]$  be a bundle of commodities

and  $[x, y, \dots, w, z]$  be their absolute abstract values

Assume that C is chosen as the general equivalent commodity (numéraire).

The relative form of values are  $[x/z, y/z, \dots, w/z]$ . Assume that  $z = 1$ .

The relative values become  $[x, y, \dots, w]$  and are transformed *in money values* because C chosen as the money commodity becomes a standard of prices and represents *the immediate social incarnation of human labour in the abstract*. According to the definition of a money value or price, it is a quantity of money per unit of a particular commodity. Assume that M is money and C belongs to the space of real objects. Hence,  $z = [M/C] = 1 \rightarrow [M] = [C]$ . Therefore, there is no formal difference between Walras' and Marx's numéraire even if Walras' prices are equilibrium prices and Marx's values transposed into market prices are compatible with the existence of money hoarding. The numéraire cannot be an abstract number equal to unity (as the standard teaching in a basic economic course). It was demonstrated at the end of section 2.2.1 that money is linked to the real world and  $x_n$  or C belongs to the world of commodities..

### 2.3 Specification of a variable standard of value

Assume that  $z(t)$  is the *variable price* of gold which is equal to a number  $\neq 1$ .  $z(t) = a(t) = [M(t)/G]$  or

$M(t) = a(t)G$ . Replacing (t) by its dimension  $[T^{-1}]$ , we have  $[M/T] = [a/T] [G]$ .

What does this mean? Simply that a certain quantity of money per period  $[M/T]$  is equal to a certain quantity  $[a/T]$  of G for the same period. It is clear that if the price of G is constant over time, for example, in a discrete time period, the dimension T cancels itself on both sides of the equality and we have  $M = aG$ , that is M is a certain (fixed) proportion of G during the discrete time period. What is the particular nature of G?

<sup>31</sup> The real space viewed as a set of real objects cannot contain an abstract number. Another incongruous question is how can  $x_n$  be a universal equivalent outside the community of economists if it is an abstract number with no particular reference to the real world? Assuming that a dollar is a dollar represents a tautological statement.

Following Marx's definition of the universal equivalent:

*"The commodity that functions as universal equivalent, is, on the other hand, excluded from the relative value form...The particular commodity, with whose bodily form the equivalent form, is thus socially identified, now becomes the money-commodity, and consequently its social monopoly, to play within the world of commodities the part of a universal equivalent."* (Marx, vol 1 pp. 68-69).

Assuming that the commodity chosen as the general equivalent has two use values: one as an *ordinary commodity* with its price related to its cost measured in terms of labour power (congealed and living labour) and the second as an *extraordinary commodity* used as a general equivalent and its value cannot not be revealed. To quote Marx on this point

*"The use-value of the commodity-money becomes two-fold. In addition to its special use-value as a commodity (gold for instance, serving as a commodity serving to stoop teeth, to form the raw material of articles, of luxury, & c.) it acquires a formal use-value, originating in its specific social function."* (Marx, vol.1, ch. 2, p 89).

Therefore, the ordinary use value of gold has a cost price in term of abstract labour (supplied by gold miners) as in any other commodity. The extraordinary use value of gold (as social monopoly) can influence the price of gold far above its cost price, especially when gold is viewed as a safe haven. The extraordinary use value of gold linking to paper money is determined by the gold market (\$35 or \$1650 an ounce). This is a price whose value (abstract labour) cannot be revealed because it serves as the general or universal equivalent This is the speculative or market price as a reserve of value and it is this price which links the foundation of money to the real world.

This point of view is in total contradiction with Post-Keynesian economists who believe that state money is the only reality. The Chartalist post-Keynesian school<sup>32</sup> following Knapp (1924) and Kaldor (1964) argues that even if central bank money is a debt there is no obligation to reimburse it. Quoting S. Bell, "The general acceptability of both state and bank money derives from their usefulness in settling tax and other liabilities to the state. This enables them to circulate widely as means of payment and media of exchange."<sup>33</sup>

In his writings on the subject J. Smithin (2009) shares this viewpoint. When applied to the US economy, this concept assumes that the US dollar is the numéraire for the entire world and that there is an implicit assumption behind this statement that money is linked to the labour force. However, as it stands, the American labour force is not an obvious measure for the value of the dollar. Keynes was much more explicit about the wage and labour force in the short-run. Keynes'

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<sup>32</sup>The term Chartalist is derived from Latin meaning ticket or token (Knapp 1924).

<sup>33</sup>Bell (p.161, 2001) Note, in passing, the absence of any reference to money as a store of value

assumption of a fixed wage rate in the short term is a basic assumption for grounding money in the real world. Indeed, the commodity behind that assumption is labour power and the stability of money rests upon the discipline of the labour force. Financial markets are in a permanent trade-off with the state and in this lies the foundation of class struggle outside the work place.

Certainly, with financialisation at the world level, financiers who evaluate the creditworthiness of indebted states call for a reduction of state expenditures in health, education and social benefits.

Financiers, with the help of the state, also advocate raising income taxation for workers but not for the rich and the privatization of services in the public sector. This is the significance of disciplining the labour force in order to maintain the value of money. A good illustration is the financial pain imposed on the people of Greece in 2011-2012 to remain in the euro zone.

Many Marxists share a similar viewpoint when they argue that the monetary expression of labour time (MELT) is defined by the ratio of value added in money terms to the value created by the labour power. Money is then grounded to the real world by the labour force as a commodity.

However, the labour theory of value being the foundation of the Marxist approach assumes that the MELT equation is validated because the denominator is measured in abstract units of labour time. The numerator is monetary value added as the social expression of abstract labour and the problem in transforming abstract values into prices is absent. By taking concrete labour time in the denominator one has to specify how the nominal wage rate is determined. Is the wage rate fixed as Keynes assumed or is it determined by other prices?<sup>34</sup> Stated in a previous quotation,

Marx assumes that it is abstract labour produced by human labour that makes for equality between commodities, and that money is a direct expression of that social labour and requiring a link to a money-commodity. This is a concept that most contemporaneous Marxists are not ready to accept, because of their flawed understanding of the value of money in the real world. Finally, the labour force assumption as a commodity is usually accepted in a closed economy. It is not relevant to open economies unless necessary arbitrages are done through exchange rates with respect to the dominant economy. In the past US workers accepted supporting this type of repression with stagnant or lower real wage rate-- but there are limits to pauperisation. The moment of truth is approaching when the US administration will not be able to attract savings from the rest of the world at a near zero cost. Because of this one would expect the price of gold to continue to rise.

### 3.0 Model and data

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<sup>34</sup> See Loranger (2004) where the wage rate is determined simultaneously with prices when the profit rate is invariant in the transformation of values into prices. Other determinations are possible in particular from the dynamic equation  $p = (1+r)[Ap_1 + wl]$  where  $p$ ,  $r$ ,  $w$ , are market price, profit rate and wage rate, and  $A$ ,  $l$  are matrices of constant coefficients.

### 3.1 Theory behind the facts

Established in the first two sections was the necessity for maintaining a de facto link between the value of money and a commodity. The hypothesis that there is a link between the price of gold and the value of the US dollar will be verified with empirical analysis in this section and in the last section with econometric tests. The strength of this link and other determinants will be specified to explain the variations in the price of gold. Inflation is certainly a relevant variable because if gold is a hedge against inflation, one would expect a positive relation between the price of gold and inflation. Can monetary policy be another valid explanation for the variation of the price of gold? If so, then one would expect a negative relation between the price of gold and the interest rate. The Dow-Jones index can function as an index for fear like the VIX index. Since the latter is not compiled over a long period, the choice is the DJ as a proxy variable and a negative relation is expected for the period (1988-2004) as shown in Graph 5. There are many other variables that can be specified in the gold price equation and in the value of money equation. Since there is a simultaneous two equation model (z and A or E), the same variables will enter the reduced form and the structural form will be identified by imposing a priori restrictions

### 3.2 Econometric model

From section 2.1, the econometric equation to be tested is

$[MA^{-1}] = \alpha [MG^{-1}]$  that is the value of money is a proportion of gold price. This is the measure of the Euro exchange rate. For the value of money measured as weighted index with respect to the dollar it is the inverse:

$$[MA^{-1}] = \beta [MG^{-1}].$$

What are the determinants of the value of money and gold price when there are so many possible exogenous shocks? In economics, it is the ability and skill of the economist to select the most important determinants and to add a random variable for the others.

Therefore, let  $z(t) = f[X'(t); u(t)]$

where  $X(t)$  is a column vector of the most significant determinants of the price of gold and  $u(t)$  is a random variable which accounts for all other (stochastic) influences on the price of gold. With the data chosen, the vector of explanatory variables is:

$$X'(t) = (E \text{ or } A, J, p, i)$$

where E or A is the exchange rate of the US dollar with respect to another currency such as the Euro (E) or a broad index of other currencies identified as (A). This feedback of the value of money (exchange rate E or A) on gold price specifies a simultaneous model. The coefficient between these two variables in either equation is the crucial test of the null hypothesis. If it is not

significant, the null hypothesis is accepted and the hypothesis of gold as a variable standard of value must be rejected. Other determinants which include the Dow Jones index, the consumer price index and the interest rate are added as a complementary explanation of the variance of gold price. Therefore, the linear regression of the price of gold on these four determinants is:

$$z(t) = \alpha + \beta' X(t) + u(t)$$

Where  $X(t)$  is a column vector of 4 components,  $\beta'$  is a line vector of 4 parameters,  $z(t)$ ,  $u(t)$  and  $\alpha$  are scalars. The constant and random variables represent all other exogenous variables (wars, revolutions, structural changes, etc.) whose occurrences are impossible to predict or unaccounted for explicitly.

Of course, this specification can become complicated depending upon the assumptions made about  $u(t)$  and  $X(t)$ . If for instance  $u(t)$  and  $X(t)$  are not independent from each other because our model is simultaneous, then the model needs to be estimated with at least two equations. This is possible with cointegration analysis where all variables are assumed stochastic and series are non-stationary. Also it is quite likely that there is a lagged response of the price of gold to the various determinants. In which case, the model could take the form of

$$z(t) = \alpha + \beta' [H(L) X(t)] + u(t)$$

Where  $H(L)$  is an infinite polynomial in the lag operator  $L$ . It can be approximated by a rational function of two finite polynomials  $B(L)$  and  $C(L)$  of order  $m$  and  $n$  respectively. Therefore,

$$z(t) = \alpha + \beta' [B(L)/C(L)]X(t) + u(t) \text{ or}$$

$$C(L)z(t) = \alpha' + \beta' [B(L)X(t)] + v(t).$$

With auto correlated residuals, a privileged specification will be the Hildreth-Lu specification,  $(1-\rho L)z(t) = \alpha' + \beta' X(t) + v(t)$  if variables are stationary. If not, an Error Correction Model (ECM) or an estimation based on cointegration would be more appropriate.

### 3.3 The data

The symbols and data used are monthly series:

$z$  (Gold price), World Gold Council, Jan 1971-Feb.2011

$g = z/p$  (real gold price)

$J$  (Dow Jones index), StatCan, table 176-0046, Jan 1971- Feb 2011

$p$  (US consumer price index, 1982-84=100), StatCan, table 451-0009, Jan 1971-Feb. 2011

$i$  (US interest rate), FRB (Fed Reserve Board) H.15, Jan1971 – Feb 2011

$A$  (weighted average of exchange rates of strong currencies per US dollar), FRB, G.5/H.10, Jan 1973 – Feb 2011

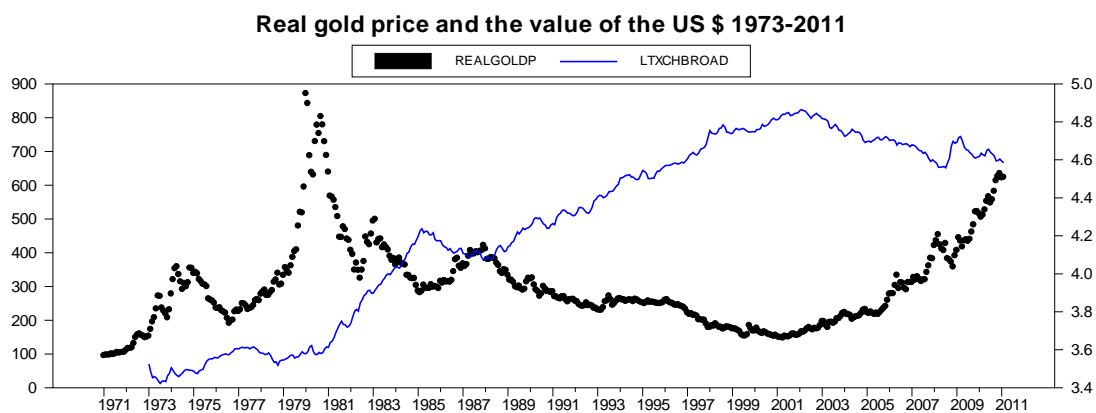
$E$  (Exchange rate US\$ per Euro), FRB, G.5/h.10, Jan1999 – Feb 2011.

Note an inverse correlation between A/US\$ and US\$/Euro when the latter increases it depreciates the dollar. Therefore, a positive correlation is expected between gold price and the exchange rate E (i.e. US\$/Euro). The opposite is expected with the exchange rate A/US\$, that is a negative correlation is expected between the gold price and the exchange rate index.

1971 was selected because it was the year the US administration (Nixon) decided that the US dollar would no longer be linked to gold and this was accomplished by terminating the Bretton Woods Agreement. In regression with A, series start in 1973 and in regression with E, series start in 1999. Note in Graph 2 (page 11) that a sharp increase in the gold price followed from 1971 to 1982 until the Reagan administration decided to raise the interest rate in 1981 to 18% in order to preserve the value of the US dollar.

The data in Graph 3 is in log form and the slope of a curve expresses the rate of growth of a particular variable. Obviously, the series are non-stationary and a first difference would likely transform them to the stationary series. Therefore, a cointegration analysis is presented after the

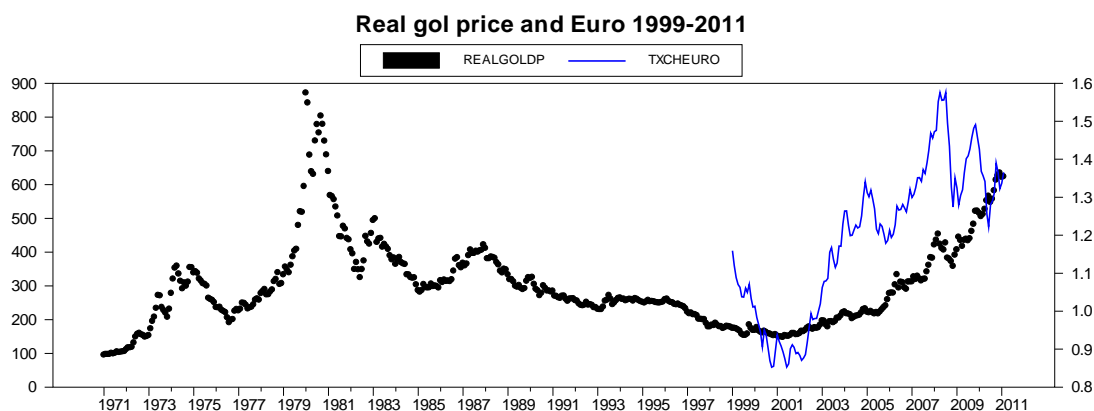
**Graph 3**



Sources: BROAD, FRB G.5/H.10, Jan 1973 – Feb 2011

regression analysis. In Graph 3, from 1985 one observes a negative correlation between gold price and the value of the US dollar. The link is strong and particularly obvious: when the value of the US dollar increases and the real value of the gold price decreases.

**Graph 4**



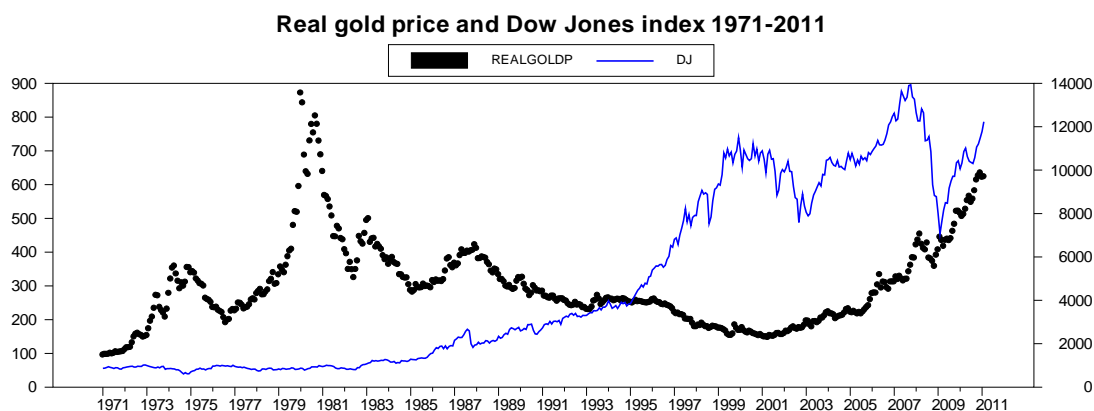
Source Euro, FRB G.5/H.10, Jan 1973 – Feb 2011

Because the euro has existed since 1999, it is interesting to concentrate the analysis on this period because it corresponds to a decrease in the value of the US dollar with a positive relationship between the price of gold and the value of the euro observed in Graph 4. Note from the data that the value of Euro in 2010 is less reliable as a reserve currency and does not reflect well the devaluation of the US dollar caused by speculative attacks against the euro.

It is interesting to note in Graph 5 a discontinuous relation between the gold price and the Dow Jones index over the whole period. Before 1988, gold price is moving in a somewhat erratic manner compared to the DJ. An inverse relation holds for the period 1988-2003 but for the period 2004-2011 a positive relation is observed. The DJ index is a measure to express the amount of optimism or pessimism and is inversely correlated with fear indexes such as VOX or VIX (Loranger, 2010). When optimism prevailed on the stock market in the period 1988-2003, speculators divested their gold stock. But since 2004, the “irrational exuberance” of investors has also affected the gold market and, except during the crash of 2007-2009, the gold price is positively correlated with the DJ. Therefore, the sign of the coefficient of this variable in various regressions (section 4) will be unstable unless a dummy variable is introduced to cope with this situation.

**Graph 5**





Source: DJ, StatCan, table 176-0046, Jan 1971- Feb 2011. Gold price, Graph 2.

## 4.0 Regression analysis

In order to facilitate the presentation of the econometric analysis, detailed estimated equations are reported in the appendix. The list and symbols of variables appearing in the various equations are mentioned above.

### 4.1 Elasticity of gold price

Firstly, econometric analysis has been conducted in terms of levels instead of relative change of the variables and not published because the series were non-stationary. Evidently, the OLS estimator cannot be applied unless series are transformed to make them stationary. Each series was tested for unit root by applying the ADF procedure and the result being one unit root for each series<sup>35</sup> (see Table A4). In order to transform non-stationary series into stationary ones, the variables are transformed in log expressed in first differences. Elasticity coefficients are obtained and are independent of the unit of measurement of variables with a prefix DL added to each variable. The coefficient will indicate which determinant has the greatest impact on the variation of gold price. To avoid multicollinearity with the price index, real gold price is used instead of nominal gold price.

$$DLg = 0.008 + 0.6662 DLE - 0.1985 DLJ$$

$$(2.81) \quad (5.71) \quad (-2.89)$$

$$Nobs = 145 \quad \bar{R}^2 = 0.1925 \quad DW = 1.87 \quad (Table A1)$$

Standardizing with respect to DLE:

$$DLE = -0.012 + 1.51DLg + 0.299DLJ$$

<sup>35</sup> If a series has a unit root, it is an indication that it is not stationary.

Figures in parentheses are t-values extracted from Table A1 and note that all coefficients are significant at a level of less than 1% and the DW statistic indicates 0 autocorrelation. Therefore, the test of proportionality between the value of money and the price of gold is significant and the null hypothesis must be rejected. The value of money is elastic (1.51) with respect to the price of gold and the latter significantly depreciates the value of the US dollar whose dimension is  $[ME^{-1}]$ . The negative relation between the DJ index and the gold price is confirmed (-0.1985) but its impact on the value of money is positive because the standardisation is reversed. A similar result is obtained with the value of money measured by a broad index of other monies with respect to the dollar  $[AM^{-1}]$ . Note that the coefficient of the weighted average is negative. But a positive coefficient could easily be obtained by taking the inverse  $[MA^{-1}]$  with the same dimension as the Euro  $[ME^{-1}]$  where E is A .

$$DLg = 0.007 - 1.4359 DLA - 0.1230 DLJ$$

$$(3.11) \quad (-8.48) \quad (-2.49)$$

$$Nobs = 457 \quad \bar{R}^2 = 0.1356 \quad DW = 1.53 \quad (\text{Table A1})$$

Again, the hypothesis of 0 autocorrelation is accepted although the explained variance of gold price is smaller with a determination coefficient of 13% only. Even if there is a significant relation between gold price and the value of money, there are many other causes or shocks that can impact the price of gold. Standardizing with respect to DLA:

$$DLA = 0.005 - 0.696DLg - 0.009DLJ.$$

Note that it is the gold price coefficient that has the greatest impact on the value of money since the other two coefficients are near 0. Therefore the null hypothesis must be rejected in favour of a significant link between the value of money and the price of gold. The interaction between gold price and the value of the US dollar in this specification is a simultaneous one. The specification of a dynamic simultaneous model of two equations is required.

## 4.2 Cointegration analysis

As previously mentioned, tests of unit roots were made for each variable (Table A4) and the hypothesis of 0 unit root is rejected in each case. The specification of an Error Correction Model (EMC) or cointegration model is appropriate for this situation. Moreover, the model is a dynamic model according to the number of lags specified. A two-lag specification seems appropriate in order to let monetary policy fully impact on gold price. It has been established in another study<sup>36</sup>

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<sup>36</sup> F. Capie, T.C.Mills, G.Wood, "Gold as a Hedge against the US Dollar," World Gold Council, Research Study no. 30, September 2004.

that gold price reacts quickly to other variables. Therefore, the advantage of using this type of model is to separate short-term fluctuations from stable long-run relations.

A cointegration relation is defined as a **stationary linear combination** of variables where some or all are non-stationary.<sup>37</sup> All variables are stochastic and react simultaneously. The number of cointegration relations **r** (rank) or the number of unit roots (**q-r**) is determined by a rank test, **q** being the number of variables in the system. The tested hypothesis is to reject (q-r) unit roots if the trace of the cointegration matrix is above the critical value at 5% level and accept it when it is below the critical level. At least one cointegration relation has to correspond to the gold price equation or the money value equation. With more than one cointegration relation there is an identification problem, the solution being to specify a priori constraints or restrictions on some parameters of the cointegration matrix. The model is a dynamic one and lags need to be specified in order to estimate short-run matrices for each lag.<sup>38</sup> By separating short-term effects from long-run relations, the purpose of the model is to estimate a stable relation between the set of chosen variables. Short-run results are not reported and the analysis will concentrate on stable long-run relations among variables.<sup>39</sup>

#### **a) Estimation with A**

Unrestricted 2 cointegration relations

$$LA = 0.201Lz + 0.366LJ - 0.458Lp + 0.116Li$$

$$Lz = -2.610 LA + 0.174LJ + 3.021Lp - 0.047Li$$

$$\text{Nobs} = 458 \quad \text{lag} = 2 \quad \text{rank} = 2 \quad (\text{Table A2})$$

Note here that long-term variables are in log level instead of first differences. Nominal gold price *z* is used instead of real gold price *g*. The rank test indicates there is at least one cointegration relation and the possibility of two because the calculated trace value (47.578) is very close to its critical value at the 5% level. Two cointegration relations were specified and the unconstrained estimated results appear in Table A2 and are presented above in a more usual form indicating that a cointegration relation is well identified in the gold price equation with the expected sign.

Standardization of the first cointegration relation with respect to the value of money is a poor choice because of the positive coefficient (0.201). This being opposite to what is seen in Graph 3 where a negative relation is observed. However, the second cointegration identified with the price

<sup>37</sup> Results reported in Tables A2 and A3 have coefficients with opposite signs compared to those reported in this section. When a linear combination is estimated, all variables are on the left side of the relation and only an error term appears on the right side justifying it as an error correction model.

<sup>38</sup> Short-run matrices are the coefficients of first differences variables transformed in log. The size of these matrices is equal to the number of variables in the system.

<sup>39</sup> The constant term is specified outside the cointegration matrix and is not reported here as the season dummy variables.

of gold is in accordance with the previous results: when the value of the US dollar increases, the price of gold decreases. In order to better identify this two equation system, some a priori constraints need to be specified. From Graph 5, a negative relation exists between the price of gold and the Dow Jones index. The elimination of the LJ variable in the gold price equation and the Lp variable in the money equation will give an exactly identified model with significant Student-t values.

Restricted

$$\begin{aligned} LA &= 0.036Lz + 0.281LJ + 0.078Li \\ &\quad (0.67) \quad (8.91) \quad (2.60) \\ Lz &= -1.950 LA + 2.956Lp - 0.093Li \\ &\quad (-7.61) \quad (11.10) \quad (-2.16) \end{aligned}$$

However, note that the coefficient of the gold price in the value of money equation is not significant; the null hypothesis could be accepted and the interest rate coefficient has the wrong sign. It looks as if the value of the dollar is essentially controlled by the stock market with a positive sign. This equation requires a better identification with more explanatory variables or it should be excluded because there is only one significant cointegration relation corresponding to the second cointegration relation. All coefficients are significant with proper expected signs. Therefore, the null hypothesis is rejected. If the standardisation is made with respect to LA, the causality is reversed.

$$LA = -0.513Lz + 1.516Lp - 0.048 Li.$$

The value of other currencies measured in dollars reacts negatively to the price of gold (it takes fewer dollars to buy a unit of A); it reacts positively to inflation and increases with an austere monetary policy (although this effect is relatively small). It is clear that the null hypothesis is rejected.

## b) Estimation with E:

Unrestricted 1 cointegration relation

$$\begin{aligned} Lg &= 0.603 LE + 2.554LJ - 0.300Li \\ &\quad (1.74) \quad (5.41) \quad (-5.95) \quad \text{or :} \\ LE &= 1.658Lg - 4.235LJ + 0.498Li \\ &\quad (5.05) \quad (-4.42) \quad (4.01) \end{aligned}$$

Nobs = 146    lag = 2    rank = 2    (Table A3)

From Table A3, the rank test shows that there is no cointegration relation with this set of data. This is rather surprising result. Setting aside the rank test, it was decided to specify two lags and one cointegration relation in order to compare with the previous set of results. One of the most interesting outcomes is that there is a positive relation between LE and Lg. This means that when the dollar depreciates with respect to the euro (it takes more dollars to buy one euro) the price of gold increases and when there is an increase in the gold price the value of the dollar decreases. According to t values, the second equation is the best one: euro is a significant function of real gold price. The null hypothesis is rejected. The negative relation between the euro and the DJ is validated and the impact of the US monetary policy is positive for the euro. A quantitative easing policy decreases the value of the dollar with respect to the euro.

For the econometric tests the best results are for the proportional variation model and the one cointegration model. The reason being that the series are non-stationary and by taking first differences of log variables, this eliminates non-stationary property from the series although remaining a simultaneous exercise.

**Table 3 Best estimated equations**

<p><b>a) Proportional variations</b></p> <p><b>Other money A</b></p> $DLg = 0.007 - 1.4359 DLA - 0.1230 DLJ \quad \text{or}$ $DLA = 0.005 - 0.696DLg - 0.009DLJ$ <p><b>Euro R</b></p> $DLg = 0.008 + 0.666 DLE - 0.198 DLJ \quad \text{or}$ $DLE = -0.012 + 1.510DLg + 0.299DLJ$ <p><b>b) One cointegration relation</b></p> <p><b>Other money A</b></p> $Lz = -1.950LA + 2.956Lp - 0.093Li \quad \text{or}$ $LA = -0.513Lz + 1.516Lp - 0.048Li$ <p><b>Euro E</b></p> $Lg = 0.603LE + 2.554LJ - 0.300Li \quad \text{or}$ $LE = 1.658Lg - 4.235LJ + 0.498Li$
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An alternative is to use a cointegrated model where series can be non-stationary and form a stationary linear combination. This is the best method because it is a dynamic model with a few lags and gives long-run stable relations between variables. Explanatory variables are treated as stochastic regressors instead of fixed values. However, the existence of two significant cointegration relations does not work with the two sets of data. As shown in Table 3 above, only one cointegration relation can be clearly identified with significant coefficients and, in all cases, the null hypothesis is rejected. Therefore gold as a variable standard of value matters in determining the value of money although it can be influenced by many other shocks.

## **Conclusion**

The object of this paper was to show that the value of money cannot be understood without referencing it to its place in the real world and also referencing it as a commodity. The first section was devoted to examining the new form of the US dollar in relationship to financial derivative products and the phenomenal expansion and the size of the derivative market as the basis for the strength of the dollar. Which commodity is best suited to link the value of the dollar to the real world: can oil or gold be the variable standard of value for the dollar? If so, what kind of international monetary reform should be undertaken? In the second section, using dimensional analysis, a formal identification of Walras' numéraire proved to be the same as Marx's numéraire. This may be contestable because there is a difference between Walras' approach and Marx's approach. While Walras' general equilibrium rules out any excess of money, Marx's money circuit is based on the existence of value reserve and therefore, on hoarding. In Walras' approach money is neutral and only relative prices are relevant. In Marx's approach it is the absolute level of value and prices that is relevant because money needs to be grounded to a commodity chosen as a general equivalent. This viewpoint seems passé for most Post-Keynesian and Marxian economists because they believe that state money with a flexible exchange rate is the only relevant hypothesis for money. However, Post-Keynesian and Marxian economists ignore that there is a commodity backing the value of their money--the labour power. If this is accepted it has consequences for the credibility of money: state indebtedness demands that the burden is shifted to the labour force and a new form of class struggle develops outside the

work place by the reduction and cutting of social services and the systematic replacement of those services by the private sector.<sup>40</sup>

The US dollar has been disconnected from gold as *de jure* reserve currency since 1971: gold remains a *de facto* variable standard of value for the US dollar. The plausibility of such a hypothesis is based on what has been observed on the exchange rate markets: by moving from a fixed exchange rate system to a variable one. The value of money changed from a fixed gold standard to a variable one. Therefore, the null hypothesis was to show there is no link between the value of money and the price of gold when it acts as a variable standard of value. In the third section data and an econometric model were used to test the null hypothesis. The results presented in the last section show that with a one equation model the null hypothesis is clearly rejected in favour of a significant strong link between the value of the dollar and gold. However, in a simultaneous model of two equations, the null hypothesis could be accepted according to the (weak) specification formulated. The rank test with the euro data is in accordance with no cointegration relation, the simultaneous model is rejected in favour of a one equation model. Significant links between gold price and other explanatory variables exist, in particular, with respect to interest rate: a tight monetary policy impacts negatively on gold price after a few periods. Finally, the relation between gold price and the DJ is negative: gold price decreases when the DJ increases. The obvious negative relation in the period of 1988-2004 seems to be dominant.

Obviously, additional research using more variables is required. With a single cointegrated equation, the null hypothesis is rejected whether the value of the dollar is measured with respect to the euro or to any other combination of exchange rates. It can be safely concluded that despite the strong opposition by economists from different schools of thought, gold is still relevant for determining the value of money. Labour power cannot be a good substitute for gold because it would imply that a wage rate in a particular country would be chosen and accepted universally.

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<sup>40</sup> This statement is not shared by some progressive economists who think that the capacity of borrowing is not limited within a national framework. This is an illusion because even in a large economy like the US economy, quantitative easing is limited by the capacity of the international market to absorb US securities of all kinds.

## Appendix

### Detailed regression results

**Table A1 Regression of gold price (proportional variables)**

Dependent Variable DLg

Monthly Data From 1999:02 To 2011:02

Usable Observations 145 Degrees of Freedom 142

Centered R\*\*2 0.203797 R Bar \*\*2 0.192583

Durbin-Watson Statistic 1.875949

Variable	Coeff	Std Error	T-Stat	Signif
*****				
1. Constant	0.008385019	0.002980229	2.81355	0.00559500
2. DLE	0.666160057	0.116575023	5.71443	0.00000006
3. DLJ	-0.198513754	0.068575828	-2.89481	0.00439374

Dependent Variable DLg

Monthly Data From 1973:02 To 2011:02

Usable Observations 457 Degrees of Freedom 454

Centered R\*\*2 0.139426 R Bar \*\*2 0.135635

Durbin-Watson Statistic 1.528639

Variable	Coeff	Std Error	T-Stat	Signif
*****				
1. Constant	0.007078165	0.002276294	3.10951	0.00199185
2. DLA	-1.435918003	0.169195184	-8.48675	0.00000000
3. DLJ	-0.123013187	0.049467072	-2.48677	0.01324919

**Table A2 Cointegration Model with A and 2 LAGS**

Sample: 1973:01 to 2011:02 (458 observations)

Effective Sample: 1973:03 to 2011:02 (456 observations)

Obs. - No. of variables: 445

System variables: Lz LA LJ Lp Li

Constant/Trend: Unrestricted Constant

Lags in VAR: 2

Rank test

p-r r Eig.Value Trace Trace\* Frac95 P-Value P-Value\*

5	0	0.139	115.675	112.121	69.611	0.000	0.000
4	1	0.049	47.578	32.496	47.707	0.051	0.589
3	2	0.034	24.837	16.498	29.804	0.173	0.684
2	3	0.019	8.873	6.004	15.408	0.384	0.698
1	4	0.000	0.057	0.036	3.841	0.812	0.849

\* Trace and P=Value with a star are calculated values for small sample.



Unrestricted					
BETA(transposed)					
	Lz	LA	LJ	Lp	Li
Beta(1)	-0.201	1.000	-0.366	0.458	-0.116
Beta(2)	1.000	2.610	-0.174	-3.021	0.047
Restricted					
BETA(transposed)					
	Lz	LA	LJ	Lp	Li
Beta(1)	-0.036	1.000	-0.281	0.000	-0.078
	(-0.672)	(.NA)	(-8.910)	(.NA)	(-2.604)
Beta(2)	1.000	1.950	0.000	-2.956	0.093
	(.NA)	(7.611)	(.NA)	(-11.108)	(2.157)

**Table A3 Cointegration Model with E and 2 LAGS**

Sample: 1999:01 to 2011:02 (146 observations)  
Effective Sample: 1999:03 to 2011:02 (144 observations)  
Obs. - No. of variables: 135  
System variables: Lg LE LJ Li  
Constant/Trend: Unrestricted Constant  
Lags in VAR: 2  
Rank test

p-r	r	Eig.	Value	Trace	Trace*	Frac95	P-Value	P-Value*
4	0	0.128	29.738	27.730	47.707	0.733	0.824	
3	1	0.036	10.017	9.312	29.804	0.976	0.985	
2	2	0.023	4.699	3.991	15.408	0.837	0.898	
1	3	0.009	1.292	0.998	3.841	0.256	0.318	

a) Unrestricted cointegration relation

	Lg	LE	LJ	Li
Beta(1)	1.000	-0.603	-2.554	0.300
	(.NA)	(-1.742)	(-5.415)	(5.949)
Beta(2)	-0.322	1.000	-0.221	-0.070

b) Restricted cointegration relation

	Lg	LE	LJ	Li
Beta(1)	1.000	-2.574		0.234
	(.NA)	(-7.624)		(4.558)
Beta(2)	-0.105	1.000	-.0945	
	(-1.221)	(NA)	(-4.850)	

**Table A4 Unit root test ADF with 6 lags**

Variables	Calculated T
Gold price (z)	1.796
Euro (E)	-1.121
Exchange rate (A)	-1.456
DJ (J)	-0.115
CPI (p)	-0.139
Txint (i)	-1.529
Critical value 5%	-2.867

All calculated T values are above the critical algebraic value  
so the null hypothesis (0 unit root) must be rejected.

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